

Use of Apollo 17 epoch neutron spectrum as a benchmark in testing LEND collimated sensor

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The Apollo 17 neutron experiment LPNE provided a unique set of data on production of neutrons in the Lunar soil bombarded by Galactic Cosmic Rays (GCR). It serves as valuable “ground-truth” in the age of orbital remote sensing. We used the neutron data attributed to Apollo 17 epoch as a benchmark for testing the LEND’s collimated sensor, as introduced by the geometry of collimator and efficiency of He3 counters. The latter is defined by the size of gas counter and pressure inside it. The intensity and energy spectrum of neutrons escaping the lunar surface are dependent on incident flux of Galactic Cosmic Rays (GCR) whose variability is associated with Solar Cycle and its peculiarities.

We obtain first the share of neutrons entering through the field of view of collimator as a fraction of the total neutron flux by using the angular distribution of neutron exiting the Moon described by our Monte Carlo code. We computed next the count rate of the 3He sensor by using the neutron energy spectrum from McKinney et al. [JGR, 2006] and by consider geometry and gas pressure of the LEND sensor. Finally the neutron count rate obtained for the Apollo 17 epoch characterized by intermediate solar activity was adjusted to the LRO epoch characterized by low solar activity. It has been done by taking into account solar modulation potential, which affects the GCR flux, and in turn changes the neutron albedo flux.